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Pilot Study: Effectiveness of Stress Management Strategies on Perceived Level of Academic Stress and Biochemical Marker Among Pre University Students

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Abstract: Background: Academic stress is a growing concern among pre-university students, often leading to negative psychological and physiological outcomes. The current study aimed to evaluate the effectiveness of structured stress management strategies on perceived academic stress and biochemical markers among pre-university students in Karnataka. Methods: A quasi-experimental research design was adopted. Twenty students were selected using a convenience sampling technique. Participants aged 16–18 years with mild to severe academic stress levels were included. The intervention group received an integrated stress management program for eight weeks, while the control group received no intervention. Results: The experimental group showed significant reductions in ASS, PSS, and cortisol levels ($p<0.001$), while the control group showed no notable change. Significant group × time interactions ($p<0.001$) confirmed the intervention's effectiveness. Conclusion: The integrated stress management strategies were effective in significantly reducing both perceived academic stress and physiological stress markers. Educational institutions should consider implementing structured stress reduction programs to enhance student well-being and academic performance.

Key Words: Academic Stress, Stress Management, Pre-University Students, Perceived Stress, Cortisol

INTRODUCTION

Academic stress among pre-university students has become a critical area of discussion, particularly as it relates to the effectiveness of stress management strategies in mitigating stress levels and enhancing overall well-being. The increasing pressure associated with academic demands has shown detrimental effects on students' mental, emotional, and physical health, necessitating effective interventions. Studies indicate that diverse stress management interventions, which include Cognitive Behavioral Therapy (CBT), mindfulness-based stress management and relaxation programmes, have a significant effect on student perceptions of stress as well as biochemical outcomes related to stress responses [1,2].

The efficacy of stress management interventions often hinges on their design and the specific challenges faced by students. For instance, CBT- and mindfulness-based interventions have been documented to help students reframe their responses to stressors, thus improving their coping strategies [3]. Moreover, systematic reviews highlight the importance of psychoeducation as a core component, enabling students to recognize stressors and develop resilience against academic challenges [4].

Studies have shown that techniques such as diaphragmatic breathing are effective strategies for stress reduction among university students. Diaphragmatic breathing, in particular, is simple to implement and has been demonstrated to lower perceived stress levels as well as physiological markers like cortisol [5,6].

Furthermore, studies have reported that effective stress reduction techniques can lead to favorable changes in biomarkers like cortisol levels, indicating the physiological impact of stress management interventions [7,8]. This biological perspective complements the psychological understanding of stress, providing a holistic view of intervention effectiveness. By addressing both perceived

stress and physiological responses, comprehensive stress management programs can significantly improve students' academic experience and overall well-being.

In conclusion, the effectiveness of stress management strategies on perceived academic stress levels and biochemical markers among pre-university students is substantiated by various studies illustrating the positive outcomes of targeted interventions. These strategies not only enhance coping mechanisms but also contribute to improved health outcomes, thereby fostering a supportive learning environment.

Researches show that stress to a certain extent help the individual to increase his productivity and creativity. Stress in moderate or severe levels can lead to physical and psychological disorders, but simple stress reducing techniques, if performed daily, can increase productivity; creativity and longevity of life and also can prevent the long-term debilitating effects of undamaged stress. So, investigator felt the need for counselling about stress management among pre-university students with a view to improve their academic performance as well as their quality of life.

Aim of the Study

The current study aimed to evaluate the effectiveness of structured stress management strategies on perceived academic stress and biochemical markers among pre-university students.

METHODS

Study Design and Sampling

This study adopted a quasi-experimental research design to evaluate the effectiveness of stress management strategies on the perceived level of academic stress and biochemical markers among pre-university students in selected colleges of Ramanagaram, Karnataka. The study was conducted at Government Pre-University College, Sugganahalli, after obtaining necessary permissions from the relevant authorities. A non-probability convenient sampling technique was used to recruit participants based on accessibility and willingness to participate. A total of twenty (20) students were selected for this pilot study.

Inclusion Criteria

- Students aged between 16 and 18 years.
- Students willing to provide written informed consent.

Exclusion Criteria

- Students with irregular school attendance.
- Students unwilling to participate.
- Students who were critically ill and unable to engage in the study.

Tools for Data Collection

The tools used in this study to assess academic stress levels included the Perceived Stress Scale (PSS) and the Academic Stress Scale, both of which are standardized and validated instruments commonly used in psychological research. These tools measure subjective perceptions of stress, helping to evaluate both general and academic-specific stress levels among students. In this study, stress was conceptualized as the psychological and physiological response to perceived academic demands or challenges, often manifesting as cognitive overload, frustration, and reduced concentration—factors known to affect students' performance and well-being.

Data Collection Procedure

Data collection was carried out after obtaining official approval from the authorities. The Academic Stress Scale (ASS) was administered as a baseline measure to assess stress levels, and only students with mild, moderate, or severe academic stress were enrolled. In addition to psychological assessment, cortisol was measured as a biochemical marker to provide an objective index of stress. The experimental group received the planned intervention program over a period of eight weeks, with sessions conducted six days per week for approximately one hour (30 minutes daily). The control group did not receive any intervention and continued with their routine academic activities. To assess the effectiveness of the intervention, both groups were re-evaluated using the same validated tools and cortisol measurement at the end of the fourth week and again at the conclusion of the eighth week.

Statistical Analysis of Data

The data were entered into a master data sheet and analyzed using descriptive statistical methods and Inferential statistics. Analysis of the significance of differences were checked using T-test, Chi-square test, ANOVA.

RESULTS

Demographic Variables

Table 1 presents the socio-demographic characteristics of students in the control and experimental groups. Both groups were found to be homogeneous across variables such as gender, type of family, parental education, and mother's occupation, with no statistically significant differences ($p>0.05$) as determined by Fisher's exact test. This confirms comparability between the two groups prior to intervention. (Table 1)

Academic and Perceived Stress

In the experimental group, both ASS and PSS scores significantly reduced from pre- to post-test ($p<0.001$), whereas the control group showed no significant change. Two-way repeated measures ANOVA revealed a significant effect of time ($p<0.001$) and a strong interaction between group and time ($p<0.001$) for both scales. (Table 2)

Cortisol Levels

After the intervention, the cortisol level of the experimental group had an improved level significantly ($p<0.001$), unable

Table 1: Socio-Demographic Variables of the Students in the Control and Experimental Groups for Homogeneity

S. No	Variable	Category	Con	Exp	Statistics
1	Gender	Male	3	2	p = 1.0
		Female	7	8	
2	Religion	Hindu	10	10	-
		Christian	0	0	
		Muslim	0	0	
		Others	0	0	
3	Native place	Karnataka	10	10	-
		Out side of Karnataka	0	0	
4	Present residence	Hostel	0	0	-
		Rented room	0	0	
		Family	10	10	
5	Type of family	Joint	3	2	p = 1.0
		Nuclear	7	8	
6	Educational qualification of father	Secondary	8	7	p = 1.0
		Higher secondary	2	3	
		Graduation	0	0	
		Illiterate	0	0	
7	Educational qualification of mother	Secondary	8	7	p = 1.0
		Higher secondary	2	3	
		Graduation	0	0	
		Illiterate	0	0	
8	Father occupation	Business	0	0	p = 1.0
		Government service	0	6	
		Laborer	10	4	
9	Mother occupation	Housewife	7	6	p = 1.0
		Government service	0	0	
		Laborer	3	4	
10	Family income	Below 10000/month	0	0	-
		10000-20000	7	8	
		Above 20000	3	2	

Table 2: Comparison of Control and Experimental Groups on Academic Stress Scale (ASS) and Perceived Stress Scale (PSS)

Group	Time Point	ASS (Mean±SE)	SS (Mean±SE)
Control	Pre-test	20.6±1.8	20.7±0.6
Control	Post-test	20.1±1.9	18.9±0.7
Experimental	Pre-test	18.6±1.4	21.0±0.5
Experimental	Post-test	13.9±1.1	12.5±0.8
Comparison Type	Scale	F / t Value	-value
Between Groups	ASS	F = 3.509	p= 0.077
	PSS	F = 14.018	p<0.001
Between Tests	ASS	F = 54.565	p<0.001
	PSS	F = 99.356	p<0.001
Group × Test Interaction	ASS	F = 35.596	p<0.001
	PSS	F = 42.041	p<0.001
Pre-test: Control vs Exp.	ASS	t = 0.902	p = 0.378
	PSS	t = 0.311	p = 0.758
Post-test: Control vs Exp.	ASS	t = 2.797	p = 0.012
	PSS	t = 6.635	p<0.001
Within Control (Pre vs Post)	ASS	t = 1.004	p = 0.328
	PSS	t = 2.463	p = 0.024
Within Experimental (Pre vs Post)	ASS	t = 9.442	p<0.001
	PSS	t = 11.633	p<0.001

to reach any significant level in the control group. Though the post-test difference between the groups was not significant (p = 0.090), there was significant interaction (p<0.001), which implies that the intervention had a beneficial effect on the physiological stress. (Table 3)

Table 3: Comparison of Cortisol Levels Between Control and Experimental Groups

Group	Time Point	Cortisol (Mean±SE)
Control	Pre-test	18.60±0.48
Control	Post-test	18.52±0.54
Experimental	Pre-test	18.44±0.52
Experimental	Post-test	17.06±0.63
Comparison Type	Cortisol F / t Value	Value
Between Groups	F = 0.917	p = 0.351
Between Tests	F = 8.720	p<0.001
Group × Test Interaction	F = 31.374	p<0.001
Bonferroni t-test		
Pre-test: Control vs Exp.	t = 0.104	p = 0.918
Post-test: Control vs Exp.	t = 1.789	p = 0.090
Within Control (Pre vs Post)	t = 0.975	p = 0.343
Within Experimental (Pre vs Post)	t = 8.896	p<0.001

DISCUSSION

The study's results demonstrate a significant reduction in both psychological (measured by ASS and PSS scores) and physiological (analyzed through cortisol levels) stress in the experimental group compared to the control group. Specifically, the reduction in ASS and PSS scores from pre-test to post-test was statistically significant (p<0.001), confirming the effectiveness of the intervention. The experimental group also showed improvements in cortisol levels (p<0.001), although the difference in post-test cortisol levels between groups was not statistically significant (p = 0.090). Nevertheless, the significant group × time interaction

($p<0.001$) suggests that the intervention effectively influenced both psychological and physiological stress outcomes.

Research supports the effectiveness of mindfulness-based and psychological interventions in reducing stress across diverse populations. Noordali et al. concluded in a systematic review that mindfulness-based interventions significantly reduced anxiety and stress in adults with diabetes, though certain studies showed no effect under intention-to-treat analyses [9]. Similarly, Dai and Liu demonstrated significant decreases in psychological stress among adolescents during the pandemic after mindful self-compassion training, underscoring the applicability of such approaches across age groups [10]. Yıldırım et al. further showed that patients with cancer benefited from mindfulness-based stress reduction programs, with marked decreases in anxiety, depression, and perceived stress [11].

Complementing these findings, Richards et al. highlighted the efficacy of psychological interventions in reducing stress among individuals with coronary heart disease [12]. Stress management training has also been shown to improve physiological health markers, including cortisol regulation. For instance, Sohmaran and Shorey confirmed through a systematic review and meta-analysis that psychological interventions significantly reduce parental stress in families with children and adolescents with developmental disabilities [13]. Lee found that laughter therapy lowered psychological stress and salivary cortisol levels in Korean student nurses [14]. Lindo et al. similarly affirmed that interventions effectively reduce stress in parents of children with developmental disabilities, reinforcing their impact across health demographics [15].

Additionally, Sanjaykumar et al. observed improvements in stress levels and overall psychological well-being in exercising women undergoing psychological interventions targeting menstrual health [16]. This supports the broader applicability of stress management strategies, aligning with the current study's findings of positive outcomes in both psychological and physiological measures.

Although the current study found no significant post-test difference in cortisol levels between groups, this aligns with mixed findings in prior literature. Schmidt et al. emphasized inconsistencies in cortisol reduction across trials, noting that while reductions often occur, statistical significance varies with study design and participant characteristics [17]. These discrepancies highlight the importance of context and methodological choices in stress intervention research, underscoring the need for further investigations to refine intervention strategies and clarify moderating factors.

CONCLUSION

The study highlights the positive effects of the implemented stress management strategies on both perceived stress scores and corresponding biochemical markers highlight the necessity for educational institutions to adopt such programs systematically. By doing so, they can not only enhance students' academic experiences but also promote their overall well-being and health.

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